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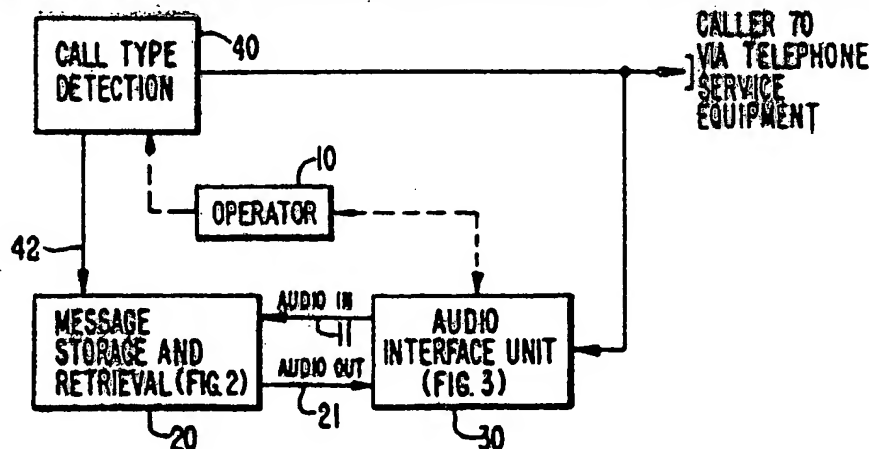**Golden Enterprises Inc.,**

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(54) **Telephone operator voice storage and retrieval system**

(57) A telephone operator voice storage and retrieval system is capable of presenting to the caller a response message in the actual voice of the operator on duty at the time. The operator (10) is also able to follow-up a played-back recorded message with a conversation with the caller (70), without the caller detecting a change in the characteristics of the caller's perceived operator voice. A storage and retrieval unit (20) employs a voice analyzer/synthesizer (32) coupled between a response message memory (51) and an audio interface (30) to the operator's audio equipment (headset). After the storage of a series of response messages, prepared by the operator, the system is ready for use in answering incoming calls. In this playback mode, as incoming calls are monitored, the appropriate operator's voice enunciated response message is accessed from memory and, via the voice synthesizer and an audio interface, that message is played back to the caller. When the caller speaks again, the operator who has been on-line the entire time but has been relieved of the need to actually recite the response phrase, now proceeds to converse with the caller. The audio interface contains automatic level control circuitry (103) which ensures that there is effectively no difference in the recorded voice played back to the caller and the 'live' voice spoken by the operator. As a result, the storage and retrieval system is listener transparent.
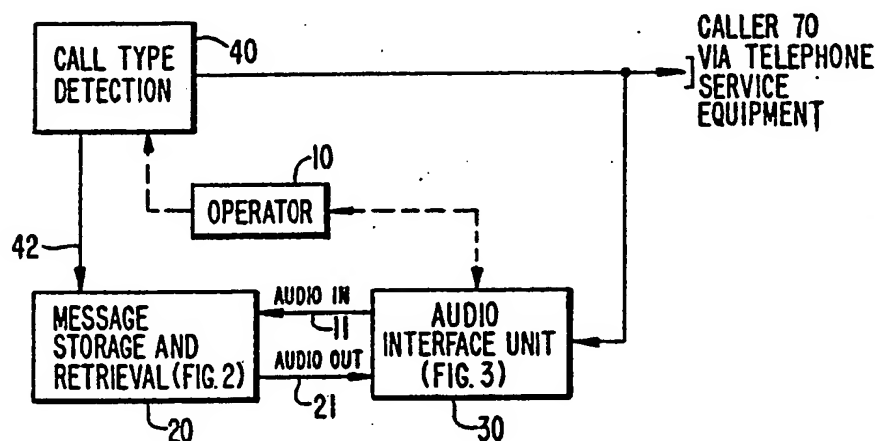
(54) Title: TELEPHONE OPERATOR VOICE STORAGE AND RETRIEVAL SYSTEM

(57) Abstract

A telephone operator voice storage and retrieval system is capable of presenting to the caller a response message the actual voice of the operator on duty at the time. The operator (10) is also able to follow-up a played-back record message with a conversation with the caller (70), without the caller detecting a change in the characteristics of the calle perceived operator voice. A storage and retrieval unit (20) employs a voice analyzer/synthesizer (32) coupled between a r sponse message memory (51) and an audio interface (30) to the operator's audio equipment (headset). After the storage a series of response messages, prepared by the operator, the system is ready for use in answering incoming calls. In th playback mode, as incoming calls are monitored, the appropriate operator's voice enunciated response message is access from memory and, via the voice synthesizer and an audio interface, that message is played back to the caller. When th caller speaks again, the operator who has been on-line the entire time but has been relieved of the need to actually rec the response phrase, now proceeds to converse with the caller. The audio interface contains automatic level control circ try (103) which ensures that there is effectively no difference in the recorded voice played back to the caller and the 'li voice spoken by the operator. As a result, the storage and retrieval system is listener transparent.

TELEPHONE OPERATOR VOICE STORAGE AND RETRIEVAL SYSTEM

FIELD OF THE INVENTION

The present invention relates, in general, to telephone systems and is particularly directed to a call answering scheme through which a prerecorded response
5   message is returned to the calling party, either through operator control, or automatically, while permitting the operator to remain on-line and have the ability to inject his/her voice into the communication link to the calling party without any detectable change in quality
10 of the voice being received by the calling party.

BACKGROUND OF THE INVENTION

Operator-assisted telephone service facilities, such as directory assistance, PBX and Toll Service, require that the service operator handle a large number
15 of similar calls over the operator's work period, with the number of daily incoming requests for assistance typically varying from 800 to 1,300, depending upon the time of day and year. Previous attempts to reduce the operator's work time employed automatical response
20 systems which contain prerecorded messages usually stored on electromechanical storage and retrieval devices (e.g. magnetic tape cassette or disk devices). Unfortunately, such systems do not alleviate the operator's burden of performing what is effectively a
25 monotonous routine. Also, differences in voice characteristics (e.g. tonal quality, accent, gender) tend to create a negative customer reaction.

An additional problem is the fact that it is extremely difficult for an operator to answer similar
30 calls with the same enthusiasm, courtesy and efficiency over an extended period of time. Incoming calls are placed by customers whose service requests to them are unique and, as such, the customers expect the service provided by the operator to be helpful, courteous and
35 efficient. If, however, the customer's call is answered by an operator whose voice response is less than desired or, even worse, by a mechanical-sounding prerecorded

response message prepared by one person's voice and then
followed by the voice of the operator, which not only is
different from that of the intercepting response message
but conveys a tone that is less than customer-courteous
5   to the caller, it can readily be appreciated how the
caller may be confused and often disappointed in the
service.

SUMMARY OF THE INVENTION

In accordance with the present invention, the need
10   to provide the operator with a mechanism for reducing
the monotonous routine of answering similar types of
calls while avoiding drawbacks of conventional automatic
response systems, such as those mentioned above, is
satisfied by a telephone operator voice storage and
15   retrieval system that is capable of presenting to the
customer (caller) a response message (selected from a
library of approved answering phrases that have been
determined to be the most effective for the inquiries
received) in the actual voice of the operator that is on
20   duty at the time. At the same time the present
invention permits the operator to follow-up the
played-back message with a conversation with the caller,
without the caller detecting a difference in the
characteristics of the played-back voice and the "live"
25   operator's voice, so that operator voice response
message storage and retrieval system of the invention is
effectively transparent to the caller.

For this purpose the present invention employs a
voice analyzer/synthesizer coupled between a response
30   message memory and an audio interface to the operator's
audio equipment (headset). The memory is preferably a
high speed/high density semiconductor RAM (such as one
contained in the form of a modular cartridge) into which
response messages read aloud by the operator are stored
35   after being digitized by the voice analyzer, during the
record mode of the system. After a series of approved
response messages, as prepared by the on-duty operator,

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having been stored, the system is ready for use in
responding to incoming calls. In this (playback) mode,
incoming calls are answered, either by the operator or
automatically and, in accordance with the type of call
5   received, the appropriate operator's voice-enunciated
response message that had been previously entered into
memory is accessed. Then, via the voice sythesizer and
an audio interface, that message (in the operator's own
voice) is played back to the caller. When the caller
10   speaks again, the operator, who has been on-line the
entire time but has been relieved of the need to
actually recite the response message, now proceeds to
converse with the caller. The audio interface contains
automatic level control circuitry which ensures that
15   there is effectively no difference in the audio level of
the recorded voice played back to the caller and the
"live" voice spoken by the operator. As a result,
because recorded message is in the operator's own voice
and both live voice and played-back voice are coupled
20   over the same signal flow path, the storage and
retrieval system is effectively listener transparent.
This listener transparency is an especially attractive
feature of the present invention, as it prevents the
operator's "live" voice from confusing the caller, as,
25   for example, would be the case if the response message
was given in a female voice abruptly followed by the
voice of a male operator handling the remainder of the
live call, or releasing a portion of the call to another
voice generated by a conventional automatic response
30   system.
       The audio interface portion of the system provides
full duplex voice transmission (and level control)
capability, allowing the operator to hear the caller's
voice regardless of line or equipment variations or
35   caller's idiosyncrasies in telephone usage.
Advantageously the system makes use of microelectronics
signal processing and storage components making it

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adaptable with a variety of telephone systems and
readily intercoupled with an existing operator's
console.

BRIEF DESCRIPTION OF THE DRAWINGS

5   Figure 1 is a simplified block diagram showing of
the telephone operator voice message storage and
retrieval scheme of the present invention;

           Figure 2 is a schematic block diagram of the
digitized voice storage and retrieval unit of the scheme
10   shown in Figure 1;   and

           Figure 3 is a schematic diagram of the audio
interface unit of the scheme shown in Figure 1.

DETAILED DESCRIPTION

           Before describing, in detail, the particular
15   improved telephone operator voice storage and retrieval
system in accordance with the present invention, it
should be observed that the invention resides primarily
in a novel structural combination of conventional
data/signal processing components and communication
20   circuits, and not in the particular detailed
configurations thereof. Accordingly, the structure,
control and arrangement of these conventional components
and circuits have, for the most part, been illustrated
in the Drawings by readily understandable block
25   representations and schematic diagrams, which show only
those specific details that are pertinent to the present
invention, in order not to obscure the disclosure with
structural details which will be readily apparent to
those skilled in the art having the benefit of the
30   description herein. Thus, for example, multi conductor
busses are simplified and power supply terminals and
leads have been omitted for clarity. In addition,
various portions of an electronic data processing system
have been appropriately consolidated and simplified in
35   order to emphasize those portions that are most
pertinent to the invention. Thus, the block diagram
illustrations of the Figures do not necessarily

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represent the mechanical structural arrangement of the
exemplary system, but are primarily intended to
illustrate the major structural components of the system
in a convenient functional grouping, whereby the present
5   invention may be more readily understood.

Referring now to Figure 1 of the drawings, there is
shown a generalized block diagram of the telephone
operator voice storage and retrieval system of the
invention which is to be associated with an
10   operator-assisted telephone service facility. Such a
facility is coupled to a link 50 which includes both
voice and call identification lines for handling and
responding to requests from a caller or customer 70.
The tip and sleeve portions of the telephone link are
15   coupled to an audio interface unit 30 (to be described
in detail below with reference to Figure 3), while those
links indicating the type of incoming call are coupled
to a detector 40. It is to be observed here that both
the voice and type of call information have been shown
20   as a single link 50 of Figure 1 for purposes of
simplifying the illustration and description. The
actual signal conveying conductors and detection
circuitry for establishing the type of call are
conventional and need not be described here for an
25   understanding of the invention.

Call-type detector 40 may be of conventional
configuration employing a bank of indicators monitored
by an operator 10 who, via a switch panel interface,
selects an appropriate code for identifying the type of
30   response message to be returned to the caller 70. This
would normally involve the operator monitoring an
optical read-out panel of call-type detector 40 and
then, via a switch panel interface, causing the playback
of a stored response message, such as from a magnetic
35   tape cassette. Rather than have the operator perform
this task, however, it is possible to employ a bank of
associated detectors, such as opto-electronic detectors,

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coupled with the indicator unit of the call-type
detector 40 of the telephone service facility of
interest, which supplies a set of codes over a link 42
to a message storage and retrieval system 20, to be
5   described below with reference to Figure 2. In other
words, the type of call being detected may be monitored
manually by the operator and the information identifying
the type of call coupled to the message storage and
retrieval system 20 by an operator switch panel
10 interface, or it may be handled automatically without
operator intervention.

The operator 10 is also coupled to the audio
interface unit 30 by way of his/her headset, so that an
on-line, "live" voice communication may be established
15 between the operator 10 and the caller 70. Pursuant to
the present invention, however, the initial
conversation/response voice interface between the
telephone service facility and the caller 70 is provided
from the message storage and retrieval unit 20 without
20 the need for the operator 10 to speak directly to the
caller 70. As mentioned previously, this not only
provides the intended relief for the operator 10, but
ensures that the caller is supplied with the correct
response message voice reply (i.e. a preestablished
25 customer-oriented and optimized response that has been
previously recorded by the operator in his/her own voice
so that the message is pleasing and informative to the
listener).

Audio interface unit 30, in addition to providing
30 on-line communication capability between the operator 10
and the caller 70, serves to provide automatic voice
level adjustment for all audio that is coupled to the
caller 70, whether that audio be generated from the
operator's headset or from the message storage and
35 retrieval unit 20. Audio signal coupling between the
audio interface unit 30 and the message storage and
retrieval unit 20 is effected over input/output

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lines 11/21.

Referring now to Figure 2, a schematic block
diagram of the message storage and retrieval unit 20 is
illustrated as being comprised of a voice input/output
5   unit 12, a call type unit 13 and a control unit 14.
Voice input/output unit 12 is coupled to audio interface
unit 30 by way of audio input link 11 and audio output
link 21. Audio input signals input over link 11
represent voice signals generated by the operator 10
10 during the response message "record" mode of operation
of the system for storing response messages to be later
played back to reply to incoming calls. These audio
signals are digitized and analyzed within the voice
input/output unit 12 and stored in digital form in
15 memory in the control unit 14. Similarly, such stored
digital encoded voice messages are read-out from memory
in the control unit 14, synchronized and coupled over
link 21 to the audio interface unit 30 for playback to a
caller 70.

20   Call type unit 13 effectively comprises a buffer
for storing an indication of the type of call for which
a reply message is to be generated. Call type unit 13
is coupled to the detector 40, either by way of a switch
panel that is operator-controlled or through an
25 automatic detector, such as an opto-electronic detector,
which monitors the operator/attendant's telephone
facility terminal. The data that is stored in buffer 41
is accessed by a control unit 14 for selecting the
appropriate response message that has been stored in
30 memory to be read-out and generated as a reply message
to be delivered to the caller 70.

The control unit 14 contains processor, memory and
communication bus components for controlling the
operation of message storage and retrieval unit 20 as
35 operator-generated response messages are stored and
later accessed and delivered to a caller, depending upon
the type of call buffered by call type unit 13.

DIGITAL STORAGE AND RETRIEVAL UNIT (Figure 2)

Looking now, in greater detail, at the components of the response message storage and retrieval unit 20 of Figure 2, within the voice input/output unit 12, audio

5   input link 11, which receives analog input signals corresponding to the audio voice supplied by the audio interface unit 30, is coupled to an analog-to-digital converter (ADC) 24. ADC 24 samples and digitized the audio input signal and couples the quantized-encoded

10 sample values of a shift register 31. Shift register 31 serializes out the digitized voice signal samples supplied by ADC 24 over link 33 to a voice analyzer/synthesizer 32. (As mentioned previously, each of the components employed in the present invention is

15 well know, so that no detailed description thereof need be supplied here. For example, the voice analyzer/sythesizer unit 32 may be a commercially available unit from OKI Semiconductor).

For providing the sampling and communication timing

20 among units 24, 31 and 32, a clock source is coupled over link 23 to each of ADC 24, shift register 31 and analyzer/synthesizer 32. It is also coupled to a divider 25 to reduce the frequency for accessing and controlling a load or shift select circuit 26 which is

25 coupled to ADC 24 over link 27 and to shift register 31 over link 28. Shift select logic unit 26 provides the appropriate digitized transfer coupling between ADC 24 and shift register 31, in a customary fashion. A separate clock is coupled over link 34 to

30 analyzer/synthesizer 32 for providing the control of the read-out analyzer/sythesizer 32.

The analog voice that is supplied from synthesizer portion of unit 32 is coupled over link 21 to the audio interface unit 30 in Figure 3, to be described below.

35 The digitized voice components supplied from the analyzer portion of unit 32 are coupled as digitized voice data over interface 35 to a buffer 36. Similarly,

the synthesizer portion receives digitized voice data
from an output buffer 37 to which voice message words
read-out of memory stored in the control unit 14 are
coupled, as will be described below.

5   Each of buffers 36, 37, 41 and a buffer 53 is
coupled to data bus 45 within the control unit 14.
Buffer 53 is coupled over link 43 to audio-interface
unit 30 (Figure 3) and stores a voice detection signal
coupled thereto from unit 30. Data bus 45 includes
10   communication highway conductors for conveying both data
and a portion of the address signals to be employed
within the control unit 14 for accessing the various
components thereof. In the exemplary embodiment, data
bus 45 may be a commercially available Z-80 type bus
15   structure.

Control unit 14 is an intelligent-based unit under
control of microprocessor 61, which is coupled to data
bus 45, to an address bus 52 and to a control bus 62 in
a conventional manner. The clock source for
20   microprocessor 61 is coupled over link 65.

In addition to microprocessor 61, control unit 14
includes a response message memory 51, such as a static
RAM in the form of a pluggable modular cartridge, and a
program store unit 46. Each of memories 51 and 46 is
25   coupled to data bus 45 and to address bus 52 for access
by microprocessor 61. Program store unit 46 stores the
instruction set for controlling the operation of the
storage and retrieval unit and the manner in which it
interfaces with the remainder of the system. As that
30   instruction set may take on a number of forms depending
upon the desires of the programmer, it will not be
described in detail here. Instead, the operational
scenario carried out by the program stored in memory 46
will be described, in order to provide a more efficient
35   description of the invention.

Control unit 14 also includes a memory select logic
unit 54 (consisting of combinational logic) through

which microprocessor 61 is selectively accesses response
message storage RAM 51 or program store memory 46 via
links 56 and 55, respectively. In addition, an
input/output select unit logic unit 44 is employed for
5   selectively accessing the contents of buffers 36, 37 and
41 during the operation of the system. Each of select
logic units 54 and 44 is accessed by control signals on
control bus 62 and address bus 52 from
microprocessor 61.

10   As mentioned previously, call type unit 13, which
comprises buffer 41, may be coupled to the control
terminal of a telephone service facility either through
the operator's control switch panel for manually
controlling the response message to be generated to the
15   caller, or through an interface unit which automatically
generates control codes to be stored in buffer 41 for
accessing the response messages stored in memory 51. In
either case, these codes are coupled over a link 42 and
stored in buffer 41. As mentioned above, an additional
20   buffer 53 is coupled over link 43. Buffer 53 is
monitored by processor 61 for initiating the operation
of the storage and retrieval unit of Figure 2. As will
be described in detail below, link 43 is coupled to a
voice detector within the audio interface unit 30
25   (Figure 3) which prevents control unit 14 from
allocating memory for incoming voice signals until there
is actually a voice signal being coupled over link 11.
THis is employed during the record mode operation
wherein the operator will record response messages in
30   her/his own voice for storage in memory 51. Line 43 is
monitored by the processor and it is not until the
operator actually begins to speak during this record
mode that the processor allocates memory for storing the
digitized voice, as opposed to simply beginning
35   successively accessing memory addresses for storing the
contents of buffer 36 to which digitized voice data is
coupled over link 35 from analyzer 32, without regard to

whether ADC 24 is actually receiving voice signals or is
waiting for those voice signals from the operator and
would thereby be supplying useless data to memory.

Operation

5　　　　Looking now at the operation of the message storage
and retrieval unit, there are two modes of operation of
the unit - RECORD and PLAYBACK

RECORD MODE

The record mode is employed by the operator at the
10　telephone service facility to record response messages
that will be used during the operator's work period.
This task may be advantageously carried out at a
redundant storage and retrieval system located in a room
or area separated from the operator's work station.　As
15　mentioned previously, the memory 51, in which response
messages are stored, may be contained in the form of a
removable cartridge module as part of the hardware of
control unit 14, whereby the operator is able to employ
a portable and compact mechanism for generating a
20　library of response messages.

Now, in the course of preparing a file of response
messages, predetermined (e.g. supervisor
approved/edited) response phrases are recorded by the
operator as the operator supplies control signals, as
25　through a switch panel coupled to detector 40, for
generating response message designation codes to be
stored by buffer 41.　The messages themselves are
coupled via the audio interface unit 30 over audio input
link 11, as described above.　The particular response
30　message codes and associated response messages are
generated and recorded by the operator in order that the
processor 61 will know where to store the response
messages in RAM 51.　Simply put, each response message
will be identified by a binary code coupled from the
35　operator switch panel over link 42 and stored in buffer
41.　For example, if the operator were to record a
response phrase indicating the name of the facility

answering the incoming call and a message of inquiry
assistance to be read back to the caller, the
corresponding switch over the operator's panel would
couple an associated code over link 42 to buffer 41.

5   The operator would then proceed to record the message to
be stored in memory. As the operator begins recording
the message, the voice detector unit within the audio
interface unit 30 (Figure 3) couples a signal over
line 43 to buffer 53. Within the control unit 14,

10   processor 61 cycles through the monitoring of
buffers 36, 37, 41 and 53 via data bus 45, address
bus 52 and control bus 62, in a conventional fashion.
When a first voice bit in buffer 53 is detected,
processor 61 begins reading out the contents of

15   buffer 36, which receives the digitized voice from
analyzer unit 32, as the voice is digitized by ADC 24,
coupled to shift register 31 and serialized over link 33
to voice analyzer 32. These digital codes,
representative of the voice message to be stored, are

20   coupled over bus 45 and stored in sequential addresses
in RAM 51. When the message is complete, as indicated
by lack of a voice detect signal on link 43, the
processor terminates the generation of address signals
for the storage of the message in RAM 51.

25   Each additional message is handled in the same way
until the operator has completed his/her recording of
all the response phrases that are to be used during the
operator's work period. The response phrase file
contained in RAM 51 may then be removed from the unit

30   employed for message recording for subsequent use in the
storage and retrieval system at the operator's work
station. Again, because the operator is able to record
his/her voice in a time frame approximate that during
which the operator will be on-line with incoming calls,

35   characteristics of the voice as stored in memory will be
substantially identical to that of the operator when the
operator is on-line.

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Playback Mode

During the playback mode of operation, when a call
type is detected, either through an operator-controlled
interface set of switches of the operator's control
5 panel, or automatically, as mentioned above, an access
code (corresponding to that originally entered by the
operator during the recording of the messages) is
coupled over link 42 to buffer 41. Then processor 61
reads the access code stored in buffer 41 and generates
10 the appropriate address signals for accessing the
corresponding response message that had been previously
stored in memory 51 during the RECORD mode. The
response message is coupled from memory 51 over bus 45
and latched in output latch 37. During the read-out
15 cycle provided by input output select logic unit 44, the
contents of output buffer 37 are coupled over link 35 to
synthesizer portion of voice analyzer/sythesizer 32, so
that analog audio signals are supplied over line 21
corresponding to the message of interest as it is
20 accessed from memory 51. These analog audio signals are
coupled over link 21 to audio interface unit 30 in
Figure 3.

AUDIO INTERFACE UNIT (FIGURE 3)

Referring now to Figure 3, there is shown a
25 schematic block diagram of the audio interface unit 30.
As explained previously, this unit is coupled to the
telephone voice lines for both the operator's position
and the caller 70, and to the storage and retrieval
unit 20 in Figure 2. At the operator's position, a dual
30 microphone input is provided from the operator's headset
at dual input jack 88. One output of dual input jack 88
is coupled over link 71 to an amplifier 101. The other
side of the jack is coupled over link 81 to the sleeve
lead of the telephone line at the operator position.
35 The other half of dual input jack 88 has one line 83
grounded while the other line 82 is coupled to the
sleeve portion of the telephone link to the caller 70.

Amplifier 101 amplifies the operator's input voice
signal from the operator's microphone to the appropriate
level for the circuitry of the audio interface unit and
couples that signal over line 102 to an automatic level
5   control amplifier 103. Line 102 is also coupled to the
output of a low pass filter 96 the input of which is
coupled to a switch 91 through link 95. Switch 91 is
coupled to the audio output link 21 from the storage and
retrieval unit 20 in Figure 2. As mentioned above,
10   link 21 supplies the read-out or synthesized voice that
had been previously stored in memory. During the
PLAYBACK mode, this voice signal is coupled over link 21
to terminal 93 and over switch link 94 to low pass
filter 96. Thus, there is an effective summation of the
15   operator's voice and the audio output over link 102 to
the input of automatic level control amplifier 103.
During the RECORD mode, there is no output over link 21
to the audio interface unit, so that switch arm 94 is
coupled to terminal 92, which is grounded.
20   The output of automatic level control amplifier 103
is coupled via link 105 to a current-voltage
converter 104, terminal 106 of switch 115 and
amplifier 115. Current-voltage converter may comprise a
transistor amplifier, the collector of which is coupled
25   over link 73 to one input of a diode bridge circuit 74.
The other input is coupled to ground. Output 75 of
bridge circuit 74 is coupled to the tip lead of the
telephone link to the operator position 10 while
output 76 is coupled to the tip lead lead of the
30   telephone link to the caller 70.
      Thus, via the dual microphone input jack 88, audio
input link 21 and outputs 75 and 76 of bridge
circuit 74, both the caller and the operator's headset
are coupled in parallel to receive the voice from both
35   the operator's microphone input and the voice from the
audio output from the synthesizer.
      As mentioned above, output link 105 from automatic

level control amplifier 103 is coupled to terminal 106
of switch 115. Like switch 91, switch 115 has PLAYBACK
and RECORD mode positions. During the PLAYBACK mode,
switch arm 111 of switch 115 is coupled to terminal 107

5 (floating), so that there is no output coupled over
link 112 from terminal 108 to a low pass filter 113.
The output of filter 113 is coupled via amplifier 114 to
audio input link 111 to the voice analyzer portion of
the storage and retrieval unit 20 shown in Figure 2. In

10 the RECORD mode, however, during which the operator is
reading aloud a response message to be stored in memory,
switch arm 111 is coupled to terminal 106, so that the
operator's voice is coupled over link 11 to the storage
and retrieval unit.

15   A further component of the audio interface unit is
a first voice detector which comprises an amplifier 116
coupled to link 105 and a monostable multi-vibrator (or
one-shot) 117 coupled to the output of amplifier 116.
The output of one-shot 117 is coupled to link 43 to

20 provide a first voice indication. Simply put,
amplifier 116 and one-shot 117 monitor line 105 for a
voice signal and then supply a trigger signal over
line 43 to be stored in buffer 41, as mentioned
previously.

25 Operation
        As mentioned above, the audio interface unit
operates in either RECORD mode or a PLAYBACK mode.
RECORD MODE
        During the RECORD mode, the operator is reading a

30 message to be analyzed and converted into digital
signals for storage in memory in the storage and
retrieval unit 20 (Figure 2). During this mode, each of
switches 91 and 115 is switched to the RECORD mode
position by the operator. The operator then speaks the

35 messages into the microphone of his/her headset. The
analog audio signals are coupled over link 71, amplified
by amplifier 101 and then level-controlled by

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amplifier 103. The output of amplifier 103 is coupled via switch 115 to low pass filter 113 and finally to amplifier 114 for application to the audio input link 11 which is coupled to the digital storage and retrieval

5   portion of the system. The operator is able to listen to his/her voice by coupling of tip leads 75 and 76 and sleeve leads 81 and 82 to the operator's position, as shown in Figure 3.

PLAYBACK MODE

10   When the operator has finished recording all of the response messages that will be employed during the operator's tour of duty, the operator changes the positions of switches 91 and 115 to the PLAYBACK position (the position shown in Figure 3). In this

15 position, switch 91 couples any audio output from the storage and retrieval unit to automatic level control amplifier 103 for application over link 73 to both output tip lead 75 and output tip lead 76. The voice signal is not coupled to the audio input link 11, since

20 switch is effectively open. Any voice signal spoken by the operator into the operator's microphone in his/her headset is coupled via amplifier 101 and link 102 to amplifier 103 and fed downstream to both the operator and caller positions in exactly the same manner as the

25 audio output from the voice synthesizer in the storage and retrieval unit as coupled over link 21. Thus, the operator is able to listen to the voice message that is being played back from the storage and retrieval portion of the system and both his/her own voice when he/she

30 speaks during further conversation with the caller. This monitoring capability and the fact that the operator is listening to his/her own previously recorded voice offers a significant improvement over conventional automatic response systems.

35   More specifically, the voice that is heard by the caller 70, whether it be the operator's own voice supplied from the operator's microphone over input

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link 71, or from the audio output from the synthesizer
over input line 21, appears to be the same voice, in
terms of quality and amplitude. The quality is the same
because the voice message is a message in the voice of
5 the operator who is actually providing the service at
the telephone facility handling the caller's incoming
call. In addition, because both the operator's voice
signal supplied from his/her microphone and the
sythesized voice signal supplied from the digital
10 storage equipment are coupled to the same amplification
and level adjustment circuitry, there is no sharp
inflection or level change between the two voice
signals. Thus, the storage and retrieval and audio
processing circuitry is effectively listener
15 transparent.

An additional advantage of the present invention is
the fact that when a response message is initially
played back to the caller, the operator, while resting,
is listening to that voice response message. When the
20 operator had previously read that message from a
carefully prepared and supervised text during the record
mode of the system, the operator did so in a clear and
courteous manner and pleasant tone while fresh and
interested. Because the operator now hears his/her tone
25 of voice being played back in such a manner, the
operator is being effectively psychologically stimulated
to follow his/her own voice and not create a
discontinuity to the listener. Thus, not only does the
present invention prevent the above-mentioned confusion
30 problem from arising, but it effectively provides
guidance for the operator in the manner in which the
operator should speak to the caller, thus acting as a
voice refresher.

While we have shown and described one embodiment in
35 accordance with the present invention, it is understood
that the same is not limited thereto but is susceptible
of numerous changes and modifications as known to a

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person skilled in the art, and we therefore do not wish
to be limited to the details shown and described herein
but intend to cover all such changes and modifications
as are obvious to one of ordinary skill in the art.

WHAT IS CLAIMED

1.   For use with an operator-assisted telephone
service facility, an arrangement for providing response
messages to an incoming caller accessing said facility
comprising:

    first means for storing at least one response
message which, when played back, effectively corresponds
to the voice of the operator to be attending to the
servicing of incoming calls; and

    second means, coupled to said first means and
operable in conjunction with the servicing of an
incoming call, for accessing said at least one response
message and causing said response message to be played
back to said incoming caller.

2.   An arrangement according to claim 1, wherein
said second means includes means for providing a path
for coupling voice messages from said operator to said
incoming caller in addition to coupling said played-back
message from said first means to said incoming caller.

3.   An arrangement according to claim 1, wherein
said second means includes means for enabling the
simultaneous coupling to said incoming caller of a voice
message from said operator and of a played-back message
from said first means.

4.   An arrangement according to claim 1, wherein
said second means includes means for adjusting, in
effectively the same manner, at least one prescribed
characteristic of each of said voice message from said
operator and said played back message from said first
means.

5.   An arrangement according to claim 4, wherein
said adjusting means includes means for adjusting the
amplitude of messages coupled by said second means to
said incoming caller.

6.   An arrangement according to claim 1,
wherein said first means comprises means for
converting a response message as voice by said operator

4   into digitally encoded format,

5   and memory for storing a response message as

6   digitally encoded by said converting means, and

7   wherein said second means includes means for

8   reconverting a digitally encoded response message

9   accessed from said memory into a voice message played

10 back to said incoming caller.

1   7.   An arrangement according to claim 1, wherein

2   said second means includes means for coupling a voice

3   message from said operator to be stored by said first

4   means through a common signal-flow path for a response

5   message played back as a voice message to said incoming

6   caller.

1   8.   An arrangement according to claim 7, wherein

2   said second means includes means for enabling the

3   simultaneously coupling to said incoming caller of a

4   voice message from said operator and of a response

5   message played back as a voice message.

1   9.   An arrangement according to claim 8, wherein

2   said second means includes means for adjusting at least

3   one prescribed characteristic of each of said voice

4   message from said operator and said played back message

5   from said first means in effectively the same manner.

1   10. An arrangement according to claim 1, wherein

2   said first means includes means for initiating the

3   storage of a response message as voiced by said operator

4   in response to the voicing of said message by said

5   operator.

1   11. An arrangement according to claim 1, wherein

2   said first means comprises means for storing a plurality

3   of prescribed response messages which, when played back,

4   effectively correspond to the voice of the operator to

5   be attending to the servicing of incoming calls, and

6   wherein said second means includes means, operable in

7   conjunction with the servicing of an incoming call, for

8   accessing a response message selected in accordance with

9   the type of incoming call being serviced and causing

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10 said selected response message to be played back to said
11 incoming caller.

1   12.   An arrangement according to claim 11, wherein
2 said second means includes means for enabling said
3 operator to monitor said incoming call and the response
4 message played back in response thereto while also being
5 able to effect a voice communication with said incoming
6 caller.

1   13.   An arrangement according to claim 12, wherein
2 said second means includes means for adjusting, in
3 effectively the same manner, at least one prescribed
4 characteristic of each of a voice communication from
5 said operator and a response message played back to an
6 incoming caller.

1   14.   For use with an operator-assisted telephone
2 service facility, a method of supplying response
3 messages to an incoming caller accessing said facility
4 comprising the steps of:
5   (a)   storing at least one response message which,
6 when played back, effectively corresponds to the voice
7 of the operator to be attending to the servicing of
8 incoming calls; and
9   (b)   in conjunction with the servicing of an
10 incoming call, accessing said at least one response
11 message and causing said response message to be played
12 back to said incoming caller.

1   15.   A method according to claim 14, further
2 including the step of
3   (c)   enabling the coupling of voice messages from
4 said operator to said incoming caller in addition to
5 causing said response message to be played back to said
6 incoming caller.

1   16.   A method according to claim 14, wherein
2 step (b) includes simultaneously enabling the coupling
3 to said incoming caller of a voice message from said
4 operator and playing back an accessed response message
5 to said incoming caller.

17. A method according to claim 16, further including the step of

(c) adjusting, in effectively the same manner, at least one prescribed characteristic of each of said voice message from said operator and said played back message.

18. A method according to claim 17, wherein step (c) includes adjusting the amplitude of messages coupled to said incoming caller.

19. A method according to claim 14, wherein step (a) comprises the steps of

(a-1) converting a response message as voiced by said operator into digitally encoded format, and

(a-2) storing a response message as digitally encoded in step (a-1), and wherein

step (b) includes reconverting a digitally encoded response message into a voice message played back to said incoming caller.

20. A method according to claim 14, wherein said step (b) includes coupling a voice message from said operator to be stored through a common signal-flow path for a response message played back as a voice message to said incoming caller.

21. A method according to claim 20, wherein said step (b) includes simultaneously enabling the coupling to said incoming caller of a voice message from said operator and a response message played back as a voice message.

22. A method according to claim 21, wherein step (b) includes adjusting at least one prescribed characteristic of each of said voice message from said operator and said played back message in effectively the same manner.

23. A method according to claim 14, wherein step (a) includes initiating the storage of a response message as voiced by said operator in response to the voicing of said message by said operator.

24. A method according to claim 14, wherein step (a) comprises the step of storing a plurality of prescribed response messages which, when played back, effectively correspond to the voice of the operator to be attending to the servicing of incoming calls, and wherein step (b) includes the step of, in conjunction with the servicing of an incoming call, accessing a response message selected in accordance with the type of incoming call being serviced and causing said selected response message to be played back to said incoming caller.

25. A method according to claim 24, wherein step (b) includes enabling said operator to monitor said incoming call and the response message played back in response thereto while also providing the capability of effecting a voice communication with said incoming caller.

26. A method according to claim 25, wherein step (b) comprises the step of adjusting, in effectively in the same manner, at least one prescribed characteristic of each of a voice communication from said operator and a response message played back to an incoming caller.

27. For use with an operator-assisted telephone service facility, an arrangement for providing response messages to an incoming caller accessing said facility comprising:

a response message storage and retrieval unit adapted to store and retrieve a plurality of prescribed response messages which, when played back, effectively correspond to the voice of the operator to be attending to the servicing of incoming calls; and

an audio interface unit, coupled to said response message storage and retrieval unit, through which a response message selectively accessed from said storage and retrieval unit in accordance with the type of incoming call is played back to said incoming caller.

28.   An arrangement according to claim 27, wherein said audio interface unit includes means for enabling the operator to monitor an incoming call and a response message accessed from said storage and retrieval unit and played back to said incoming caller, while also being able to effect a voice communication with said incoming caller.

29.   An arrangement according to claim 28, wherein said audio interface unit includes means for adjusting, in effectively the same manner, at least one prescribed characteristic of each of a voice communication from said operator and a response message played back to an incoming caller.

30.   For use with an operator-assisted telephone service facility, an arrangement for providing response messages to an incoming caller accessing said facility comprising:

first means for storing at least one response message to be played back to said incoming caller;   and

second means, coupled to said first means and operable in conjunction with the servicing of an incoming call, for accessing said at least one response message and causing said response message to be played back to said incoming caller and including means for enabling said operator to monitor said incoming call and the response message played back in response thereto and also having the capability of effecting a voice communication with said incoming caller.

31.   An arrangement according to claim 30, wherein said second means includes means for adjusting, in effectively the same manner, at least one prescribed characteristic of each of said voice message from said operator and said played back message from said first means.

32.   An arrangement according to claim 30, wherein said second means includes means for coupling a voice message from said operator to be stored by said first

4 means through a common signal-flow path for a response

5 message played back as a voice message to said incoming

6 caller.

1   33. An arrangement according to claim 30, wherein

2 said second means includes means for enabling the

3 simultaneously coupling to said incoming caller of a

4 voice message from said operator and of a response

5 message played back as a voice message.

1   . 34. An arrangement according to claim 30, wherein

2 said first means comprises means for storing a plurality

3 of prescribed response messages to be selectively played

4 back to an incoming caller, and wherein said second

5 means includes means, operable in conjunction with the

6 servicing of an incoming call, for accessing a response

7 message selected in accordance with the type of incoming

8 call being serviced and causing said selected response

9 message to be played back to said incoming caller.

1   35. An arrangement according to claim 30, wherein

2 said response message, when played back, effectively

3 .corresponds to the voice of the operator attending to

4 the servicing of incoming calls.

1   36. For use with an operator-assisted telephone

2 service facility, a method of supplying response

3 messages to an incoming caller accessing said facility

4 comprising the steps of:

5   (a) storing at least one response message to be

6 played back to said incoming caller; and

7   (b) in conjunction with the servicing of an

8 incoming call, accessing said at least one response

9 message and causing said response message to be played

10 back to said incoming caller, while enabling said

11 operator to monitor said incoming call and the response

12 message played back in response thereto and also have

13 the capability of effecting a voice communication with

14 said incoming caller.

1   37. An arrangement according to claim 36, further

2 including the step of

3   (c)   adjusting, in effectively the same manner, at
4   least one prescribed characteristic of each of said
5   voice message from said operator and said played back
6   message.

1   38.   An arrangement according to claim 36, wherein
2   said step (b) includes coupling a voice message from
3   said operator to be stored through a common signal-flow
4   path for a response message played back as a voice
5   message to said incoming caller.

1   39.   An arrangement according to claim 36, wherein
2   step (a) comprises storing a plurality of prescribed
3   response messages to be selectively played back to an
4   incoming caller, and wherein step (b) includes the step
5   of, in conjunction with the servicing of an incoming
6   call, accessing a response message selected in
7   accordance with the type of incoming call being serviced
8   and causing said selected response message to be played
9   back to said incoming caller.

1   40.   An arrangement according to claim 36, wherein
2   said response message, when played back, effectively
3   corresponds to the voice of the operator attending to
4   the servicing of incoming calls.

1   41.   For use with an operator-assisted telephone
2   service facility, an arrangement for providing response
3   messages to an incoming caller accessing said facility
4   comprising:
5   a response message storage and retrieval unit
6   adapted to store and retrieve a plurality of prescribed
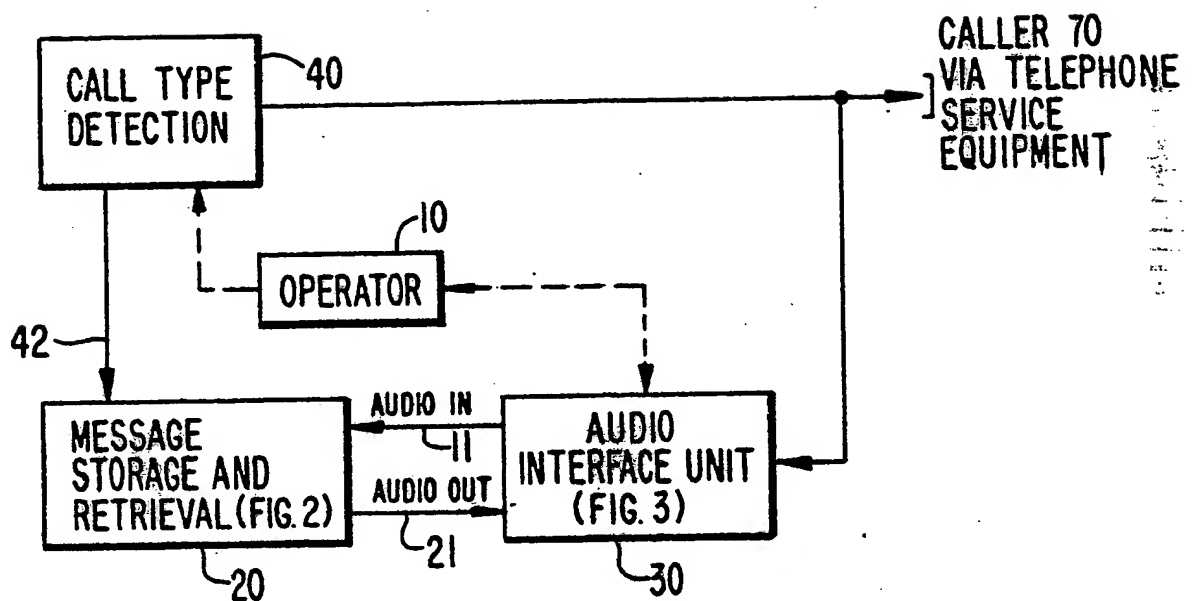7   response messages;   and
8   an audio interface unit, coupled to said response
9   message storage and retrieval unit, through which a
10   response message selectively accessed from said storage
11   and retrieval unit is played back to said incoming
12   caller, while enabling the operator to monitor an
13   incoming call and a response message accessed from said
14   storage and retrieval unit and played back to said
15   incoming caller and also have the capability of

16 effecting a voice communication with said incoming
17 caller.

1   42. An arrangement according to claim 41, wherein
2 said audio interface unit includes means for adjusting,
3 in effectively the same manner, at least one prescribed
4 characteristic of each of a voice communication from
5 said operator and a response message played back to an
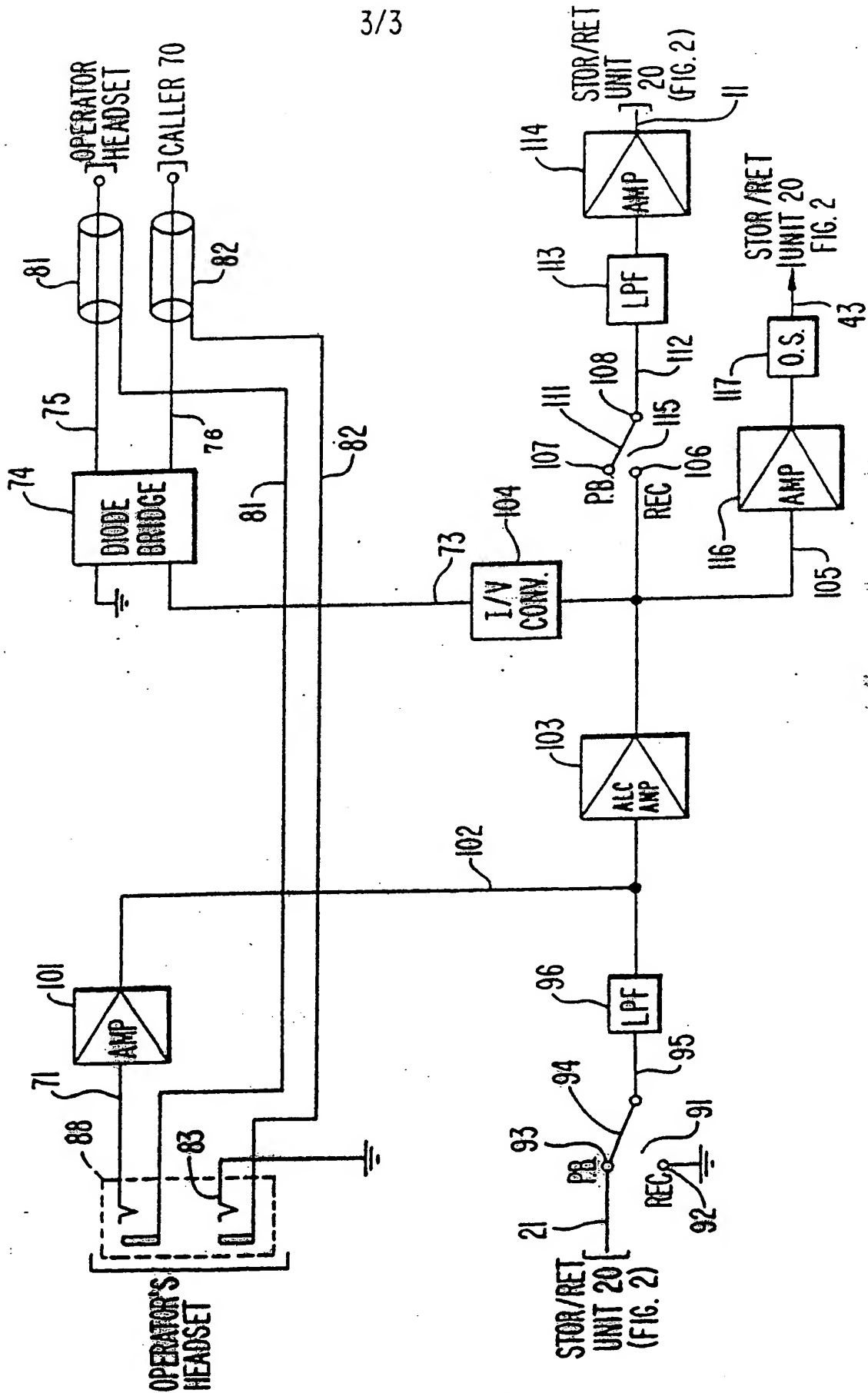6 incoming caller.

1   43. An arrangement according to claim 40, wherein
2 said response message, when played back, effectively
3 corresponds to the voice of the operator attending to
4 the servicing of incoming calls.

FIG. 1.
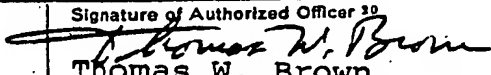
CALL TYPE DETECTION — 40

OPERATOR — 10

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MESSAGE STORAGE AND RETRIEVAL (FIG. 2) — 20

AUDIO IN — 11

AUDIO OUT — 21

AUDIO INTERFACE UNIT (FIG. 3) — 30

CALLER 70 VIA TELEPHONE SERVICE EQUIPMENT

FIG. 2.

FIG. 3.

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 3

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL.3   H04M   3/50
US. CL. 179/18B

II. FIELDS SEARCHED

Minimum Documentation Searched 4	
Classification System	Classification Symbols
U.S.	179/2CA, 6.02, 6.03, 6.04, 6.05, 6.08, 6.14, 6.17, 18B, 27D, 27FG, 27FH, 84C

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched 5

III. DOCUMENTS CONSIDERED TO BE RELEVANT 14

Category *	Citation of Document, 16 with indication, where appropriate, of the relevant passages 17	Relevant to Claim No. 18
Y	US, A, 4,420,656, 13 December 1983, Freeman	1, 14,15, 27
X/Y	US, A, 4,359,607, 16 November 1982, Hannig et al.	1,2,6,14,15, 19-21,28,30, 33,35,40,41, 43
X	US, A, 4,328,396, 04 May 1982, Theis	1-3,7,8,14-16,30,32,36, 38,41
Y	US, A, 4,277,649, 07 July 1981, Sheinbein	6,11,19,24, 27,34,39
Y	US, A, 4,255,618, 10 March 1981, Danner et al.	6 and 19
Y	US, A, 4,066,847, 03 January 1978, Giordano	40 and 43
X/Y	US, A, 3,920,908, 18 November 1975, Kraus	11,12,24,25, 27,28,34,39

* Special categories of cited documents: 15

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search 3	Date of Mailing of this International Search Report 3
15 JUNE 1985	26 JUN 1985
International Searching Authority 1	Signature of Authorized Officer 10
ISA/US	Thomas W. Brown

Form PCT/ISA/210 (second sheet) (October 1981)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

Y	US, A, 4,032,712, 28 June 1977, Catto et al.	10 and 23

V.☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [10]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1.☐ Claim numbers _____ because they relate to subject matter [12] not required to be searched by this Authority, namely:

2.☐ Claim numbers _____ because they relate to parts of the international application that do not comply with the prescribed require-ments to such an extent that no meaningful international search can be carried out [13], specifically:

VI.☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

This International Searching Authority found multiple inventions in this international application as follows:

1.☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2.☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3.☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4.☐ As all searchable claims could be searched without effort justifying an additional fee, the International Search Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (supplemental sheet (2)) (October 1981)

Application No:	GB 0030078.0	Examiner:	Richard Howe
Claims searched:	1-7	Date of search:	16 October 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): H4K (KF50E , KF50A , KF50X)

Int Cl (Ed.7): H04M (3/50 , 3/51 , 3/527)

Other: Online : wpi ; epodoc ; paj

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2 178 625 A (Golden Enterprises Inc) - see whole document	1,7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.